2 August 1968

Materiel Test Procedure 6-3-182
U. S. Army Artillery Board

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

BALLOONS (METEOROLOGICAL)

1. OBJECTIVE

The objectives of this MTP are to determine the suitability of the test item for transporting aloft meteorological devices for recording atmospheric conditions or as a pilot balloon, for soundings during daylight and periods of darkness, and to determine compliance of the test item with the essential characteristics of the Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), and the Technical Characteristics (TC's).

2. BACKGROUND

At the present time, sounding balloons are indispensable to the Army meteorologist. However, use of the balloon to acquire the desired meteorological data and the accuracy of obtained results are directly related to the technique of employment and training of the meteorological personnel. Proper inflation, use of inflation equipment, launch procedures, and computations are of vast importance in the requirement for production of accurate upper air data.

There are various types of sounding balloons. They differ chiefly with respect to weight, rate of rise, and altitude capability. In addition, balloons differ with respect to their nighttime altitude capabilities. Depending on the balloon, the lower temperatures encountered at night may cause the balloon to burst at a lower than desired altitude. Balloons designed for maximum nighttime altitudes are currently made of specially treated neoprene.

Surface and upper air meteorological conditions are of continuing importance to the Army. These conditions must be measured, recorded, and disseminated for application to artillery weapon firing data; for determining the probability of fallout patterns, depth, and arrival time; and to provide short and long range weather forecasts to the field army. The meteorological conditions existing at the time of a weapon firing, as opposed to the standard conditions on which firing table data are based, may result in deviation from the desired line of fire; an increase or decrease in the expected range of projectiles or rockets; and possible reduction in desired impact velocities.

Ballistic wind readings determined by pilot balloons are not as accurate as those readings from radiosonde observation, basically because the height of a pilot balloon must be estimated by utilization of an assumed rate of rise.

The Army requires new and improved balloons that can be conditioned and launched quickly without the existence of the many safety hazards presently associated with preparation for sounding flights, and that reach maximum altitude in the shortest possible times so as to better facilitate the rapid acquisition and dissemination of meteorological data to the using units.

3. REQUIRED EQUIPMENT AND FACILITIES

a. Suitable Meteorological Equipment Position and Launch Areas
b. Complete Artillery Meteorological Station Equipment and Personnel
c. Hydrogen Generators, ML303 and AN/TMQ-3
d. One 32-Gallon Corrugated Can
e. Antibouyancy Bracket
f. Nozzle, ML196, with weights
g. Nozzle, ML373, with weights
h. Hydrogen Regulator, ML528/GM
i. Launching Reel
j. Balloon Shroud
k. Inflation and Launching Device, ML594/U
l. Volume Meter, ML6-5/U
m. Helium Cylinder
n. Calcium Hydride Charges, ML304, ML305, and ML587
o. Shop Facilities to perform direct and general support maintenance
p. Radio and Wire Communications
q. Motion Picture Camera with Film
r. Ambulance and Aidman
s. Special Conditioning Chamber, if required

4. REFERENCES

A. USAMC Regulation 385-12, Safety.
B. USATECOM Regulation 385-6, Safety Release.
C. USATECOM Regulation 385-7, Safety Confirmation.
D. USATECOM Regulation 750-15, Maintenance Portion of the Service Test.
E. DA Field Manual 6-15, Artillery Meteorology.
F. MTP 6-3-184, Inflation, Tethering and Launching Equipment.
G. MTP 10-3-501, Operator Training and Familiarization.
H. MTP 10-4-001, Desert Environmental Test of General Supplies and Equipment.
I. MTP 10-4-002, Arctic Environmental Test of General Supplies and Equipment.
J. MTP 10-4-003, Tropic Environmental Test of General Supplies and Equipment.

5. SCOPE

5.1 SUMMARY

This MTP describes the following procedures to be performed to determine whether meteorological balloons are suitable for artillery use.

a. Receipt Inspection - A study conducted to ensure that the test item is complete and in satisfactory condition prior to initiation of testing and to determine it's physical characteristics.
b. Operational Characteristics consisting of:

1) Preparation for Operation and Operational Suitability - A study

conducted to determine the ease of preparing the test item for launching and it's launching suitability under various conditions.

2) Optimum Crew Size - A study conducted to determine the optimum crew size.

c. Environmental Suitability - A study conducted to determine the effects of various environments on the test item.

d. Human Factors Engineering - A study conducted to determine the skill level for preparing and launching the test item.

e. Safety Confirmation - A study conducted to confirm the safety release and safety requirements.

f. Maintenance Aspect - A study conducted to determine adequacy of repairing the test item and the adequacy of the repair kit and instructions.

5.2 LIMITATIONS

This test procedure is limited to the testing of meteorological balloons. The testing of the inflation, tethering, and launching equipment is described in MTP 6-3-184.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Scheduling

6.1.1.1 Personnel

a. Ensure the presence of service personnel who have been, or are being, trained using the criteria of MTP 10-3-501, and are cognizant in the inflation, tethering, and launching of the test item.

b. Record the rank, MOS, time spent in training, and time spent in the MOS for all personnel.

6.1.1.2 Equipment and Facilities

a. Requisition required supplies and special equipment not readily available at the test site.

b. Make necessary arrangements for use of equipment, special facilities, and instruments listed under paragraph 3.

c. Upon notice of arrival, or estimated time of arrival, of the test item, arrange for or secure the launching site and observation points.

6.1.2 Safety

a. Verify that the test item's safety statement is valid and up-to-date.

b. Verify that all service test personnel have been adequately trained in the safety requirements and the safety restrictions pertaining to the test item and associated equipment.

6.1.3 Receipt Inspection

Upon receipt, the test item shall be subject to the following procedures:

6.1.3.1 Arrival Inspection

a. Visually inspect the test item packaging and record the following:

1) Legibility of markings
2) Damages sustained, if any
3) Presence of foreign matter

b. Measure and record the length, width, height, and weight of the shipping package.

c. Record the number of balloons contained in each shipping package.

d. Unpack the test item, visually inspect it, and record the following:

1) How package opened (Note any requirements for opening final package materiel with a sharp instrument).
2) Nomenclature.
3) Identification number, if applicable.
4) Manufacturer.
5) Date of manufacture.
6) Evidence of damage, i.e., holes and cracks.
7) Uneven texture.
8) Uneven thickness
9) Presence of patches.
10) Weak spots.
11) Molding defects (where the balloon neck attaches to the balloon body).

6.1.3.2 Physical Characteristics

Determine and record the physical characteristics of the test item as described in the test plan or as follows:

a. Color
b. Material (rubber, neoprene, etc.)
c. Intended use

6.2 TEST CONDUCT

6.2.1 Operational Characteristics

a. Determine the operational characteristics of the test item during daylight, nighttime and during periods of inclement weather.

NOTE: These tests shall be conducted under all conditions of temperature, acceptable wind speeds, acceptable visibility, and

precipitation encountered during the testing period.

b. Record the following conditions:

1) Ambient temperature
2) Air density
3) Precipitation, if any
4) Wind speed
5) Time of test (daytime, nighttime)

6.2.1.1 Preparation for Launch and Launch Suitability

Determine the ability of the average trained crew to prepare for launch and launch the test item, conditioned and unconditioned, using commercial hydrogen cylinders with associated equipment, as follows:

NOTE: Inflation, tethering and launching shall be accomplished using the equipment as described in MTP 6-3-184.

a. Prepare the test item for launch and record the following:

1) Time required to:

a) When applicable, to perform special conditioning treatment.

NOTE: To prevent premature bursting, neoprene balloons are given special conditioning treatments before inflation. This may be done by either boiling in water or by placing the balloon in a conditioning chamber.

b) Attach the test item to the inflation device.
c) Inflate the test item to the recommended level and detach it from the inflation device.
d) When applicable, attach the meteorological devices to the test item.

2) Ease of:

a) Inflation.
b) When applicable, attachment of meteorological devices to the test item.

3) Special equipment for inflation
4) Balloon failures during inflation
5) Difficulties encountered in:

a) Attaching and/or detaching the test item to the inflation device.
b) Attaching meteorological devices to the test item.

6) Determined nozzle lift

7) Determined free lift
8) Amount of gas used

b. Launch the test item, track it optically or electrically and record the following:

1) When used, the suitability of the test item's shrouds, to include in winds in excess of 20 miles per hour.
2) The ascension rate
3) Bursting altitude

c. Photograph the ascension of the balloon with a movie camera.

d. Repeat steps a and b using commerical helium cylinders, standard hydrogen generator sets with accessories, and appropriate calcium hydrid charges.

e. Repeat steps a through c using varying amounts of gas inflation as prescribed in the test plan.

6.2.1.2 Optimum Crew Size

Repeat paragraph 6.2.1.1.a using various numbers of personnel and record the optimum crew size.

6.2.2 Environmental Suitability

Repeat the procedures of paragraph 6.2.1 using the applicable environmental criteria of MTP 10-4-001, MTP 10-4-002, and MTP 10-4-003. Special attention shall be given to:

a. Time required to complete the action of inflation and launching when dressed in special clothing and equipment.

b. Effects of heavy rainfall, continuous high relative humidity of the air, dust, insects, and fungi (mold, mildew, and slime).

c. Effects of prolonged storage.

6.2.3 Human Factors Engineering

During the conduct of the test, determine the skill level required for inflation and launching of the test item.

6.2.4 Safety Confirmation

During the conduct of preparation for launching, determine the safety of the test item by performing the following:

a. During inflation, continuously examine the test item to confirm the safety release under specified conditions of the release.

b. Confirm the requirement or nonrequirement for establishing a safety zone during the inflation operation. Determine and record the size of the inflation safety zone required.

6.2.5 Maintenance Aspect

NOTE: Due to the constructive materials of the test item, the maintenance aspect shall only relate to the repair of holes.

When applicable and/or practicable, repair the hole(s) in the test item using the appropriate repair kit and record the following:

a. Repair procedures performed
b. Adequacy of instructions
c. Shortcomings in the repair kit
d. Adequacy of the repairs

6.3 TEST DATA

6.3.1 Preparation for Test

6.3.1.1 Personnel

Record the following for all service test personnel

a. Rank
b. MOS
c. Time spent in training, in weeks
d. Time spent in MOS, in months

6.3.1.2 Arrival Inspection

a. Record the following for the test item packaging:

1) Legibility of markings
2) Damages sustained, if any
3) Presence of foreign matter
4) Measurements:

a) Length, in inches
b) Width, in inches
c) Height, in inches
d) Weight, in pounds

5) Number of balloons in each shipping package
6) How package opened

b. Record the following for the test item:

1) Nomenclature
2) Identification number, if applicable
3) Manufacturer
4) Date of manufacture
5) Evidence of damage
6) Uneven texture
7) Uneven thickness
8) Presence of patches

9) Weak spots
10) Molding defects

6.3.1.3 Physical Characteristics

Record the following:

a. Color
b. Material
c. Intended use

6.3.2 Test Conduct

6.3.2.1 Preparation for Launch and Launch Suitability

a. Record the following for each performance:

1) Time of test (day, night).
2) Ambient temperature, °F.
3) Air density, pound per cubic feet.
4) Precipitation, if any.
5) Wind speed, in mph.
6) Method of inflation (standard hydrogen generator sets, commercial helium cylinders, etc.).

b. Record the following for each launch preparation:

1) Time, in minutes, required to:

a) When applicable, perform special conditioning treatment.
b) Attach and detach the test item from the inflation device.
c) Inflate the test item to the recommended level.
d) When applicable, attach the meteorological devices to the test item.

2) Ease of:

a) Inflation.
b) When applicable, attachment of meteorological devices to the test item.

3) Special equipment required for inflation.
4) Balloon failures during inflation
5) Difficulties encountered in:

a) Attaching and/or detaching the test item to the inflation device.
b) Attaching meteorological devices to the test item.

6) Muzzle lift, in grams
7) Free lift, in grams

8) Amount of gas used, in cubic feet
9) Optimum crew size

c. Record the following for each launch:

1) When used, the suitability of the test item's shrouds
2) The ascension rate, in fps
3) Bursting altitude, in feet

d. Retain all photographs.

6.3.2.2 Environmental Suitability

Data shall be collected and recorded as required by paragraph 6.3.2.1 using the criteria of MTP 10-4-001, MTP 10-4-002, and MTP 10-4-003 and the following:

a. Effect of special clothing on operation times.
b. Effect of extreme environmental conditions on test item ascent and bursting height.
c. Effects of prolonged storage at extreme temperatures on test item handling and operating characteristics.

6.3.2.3 Human Factors Engineering

Record the skill level required for launch preparation.

6.3.2.4 Safety Confirmation

Record the following as determined during preparation for launching:

a. Confirmation of the safety release.
b. Confirmation of the requirement or nonrequirement for establishing a safety zone during the inflation operation.
c. The size of the inflation safety zone.

6.3.2.5 Maintenance Aspect

Record the following:

a. Repair procedures performed
b. Adequacy of instructions
c. Shortcomings in the repair kit
d. Adequacy of the repairs

6.4 DATA REDUCTION AND PRESENTATION

a. All data shall be recorded and retained in log form for reference and comparison purposes.
b. All photographs shall be retained.
c. The obtained data, when analyzed and reduced to recurrent failures

or design shortcomings, shall determine the degree that the test item meets the requirements of the QMR and TC.

d. Present the data on the balloon as it is effected by daylight, nighttime, inclement weather, extreme environmental conditions.